Rise of superbugs threatens antibiotic crisis

'What is alarming is the rate at which bacteria are becoming resistant to antibiotics', says WHO adviser Dr Danilo Lo Fo Wong. Photograph: Murdo Macleod

An extraordinary scene plays out in hospitals across Britain that is a harbinger of crisis ahead. Patients brought in for routine operations pick up infections that until recent times seemed trivial. Now they can be killers. Even the most modern, and powerful, antibiotics can no longer save them.

The story of the superbug MRSA raised awareness of the growing uselessness of antibiotics, but that has been brought largely under control through better hygiene, at least in the UK.

The rise of other lethal drug-resistant organisms, including salmonella, TB, and E coli, continues, and the chief medical officer, Dame Sally Davies, warned MPs this week the threat must be listed on the government's National Register of Civil Emergencies.

The problem is not a local one. In Davos on Thursday, health officials gathered for a session called "The dangers of hubris to human health", after the World Economic Forum listed antibiotic resistance in its Global Risks report this month. The meeting's aim was to reassess the risks posed by the abuse and misuse of antibiotics that make lethal bacteria immune to our best defences. The meeting acknowledged that the historic success of antibiotics has lulled us into a false sense of security.

"To put it bluntly, we are running out of ideas. That's the problem we face. For many years we have been one step ahead of evolution, but in the past 25 years, we have failed to develop new antibiotics," said Danilo Lo Fo Wong, a senior adviser on antimicrobial resistance to the World Health Organisation.

The rise of antibiotic resistance began when they were introduced 60 years ago. Whenever the drugs are used, they wipe out weak bugs but survivors multiply and become ever more resilient the more antibiotics are used: natural selection in action.

"What is alarming is the rate at which bacteria are becoming resistant to antibiotics," says Dr Wong. "We are increasingly seeing infections that do not respond to these drugs, and the more treatments fail, the more people die."

Over the past 60 years, the pharmaceutical industry has churned out three generations of antibiotics. The first included natural penicillins. These fell by the wayside as bacteria evolved enzymes that broke the drugs apart. The second were synthetic penicillins, modified in the lab to resist the bugs' enzymes. Bugs gained resistance to these too. The third generation, carbapenems, are modified even more. In 2003, the first microbes arrived in Britain that are immune to them.

In evidence to the science select committee this week, Davies told MPs that the pipeline for new antibiotics had dried up, and that the market model for delivering new antibiotics was broken.

The reasons are many. In the 1990s and 2000s, big pharma largely gave up on antibiotics, which made merely hundreds of millions of dollars, in favour of blockbuster drugs that made billions. They focused on drugs for chronic diseases, such as heart disease. These patients take drugs for years, rather than days, so profits are likely to be higher. At the same time, many pharmaceutical firms closed their research centres.

There are other problems. Bacteria evolve at such a rate that any new antibiotic that is developed has only a short window in which it will work. Knowing this, and that governments are doing their utmost to keep antibiotic prescriptions to a minimum, are hardly incentives to invest in a decade of research to find a new drug.

Wong said moves were in train to develop new business models for whenever a new antibiotic is developed. The idea is radical. Instead of rushing to market, through government support, the drug would be held in reserve for emergencies.

David Brown – inventor of Viagra and chair of the Babraham research campus near Cambridge, which is home to 32 biotech firms – said big pharma companies should focus on manufacturing, running clinical trials, and marketing drugs. The new ideas for those drugs, he said, will come from biotech companies and universities. Brown knows the industry well. He worked at Glaxo Smithkline, Pfizer and latterly was head of drug discovery at Roche.

Brown has partnered with Sunil Shaunak, professor of infectious diseases at Imperial College London, to develop a radical new approach to combating bacterial infections, one that bugs cannot become resistant to. Instead of killing the bacteria, it manipulates the person's defences to prevent bugs getting into the bloodstream.

"Continuing with the old-fashioned approach of attacking bacteria is running out of steam. We need to re-educate people that antibiotics are not a panacea," said Shaunak. In early trials, the drug has proved "as good as you could ever imagine", added Brown.

One major hurdle faced by drugs companies is the regulatory hoops they must jump through to get a drug to market. Typically, a company must do two large-scale trials, involving thousands of people, before a drug is approved. "The problem is, if we wait until we can do two large-scale trials, we've waited too late. The epidemic is upon us," said John Rex, head of infection, global medicines development, at AstraZeneca.

A new strategy put forward by Rex and others is to be adopted by the European Medicines Agency and the Food and Drug Administration in the US. Under the new proposals, drug companies will do what trials they can in infected people, but can

run more safety tests in healthy people, and prove efficacy through tests on bugs in laboratories. "This speeds the process up enormously, because for some drugs, the speed right now is zero."

Any antibiotics that are approved through the new regulations may be labelled to declare their limited testing, and be handed only to specialist doctors, to use only if they have no other options.

"Modern medicine is not possible without effective antibiotics and the global pipeline is frighteningly thin," he said. "If we don't fix this, we are all in serious trouble. It means not getting that hip replaced, not having care for your premature baby, and not having cancer treated."